

MODIS Quarterly Report, JULY 1996
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This reports covers the **aerosol ocean** and **aerosol land** algorithm, the **NIR water vapor** algorithm and our involvement in the **fire algorithm**.

Main topics addressed in this quarter:

1. Preparation of algorithms for the version 1 delivery (*Gao, Mattoo*)
2. Tests and improvements in the land algorithm: selection of the 3.75 μm band (rather than 3.95) (*Chu, Mattoo*)
3. Validation of the aerosol algorithms and summary of the scientific results in publications (*Kaufman, Tanre et al.,*)
4. Analysis of the SCAR field experiment data (*Chu, Li, Remer*)
5. Organization of the workshop on remote sensing of aerosol and atmospheric corrections (*Kaufman, Tanre*)
6. Preparation for the TARFOX field experiment (*Kleidman, Remer et al.*).
7. Start of an analysis of the meaning of remote sensing of aerosol, the meaning of optical thickness, for understanding the aerosol effect on clouds, radiation and atmospheric chemistry (*Kaufman, Tanre*).
8. Preparation for a laboratory experiment, in the Forest Service Fire Lab. with an CIA/John Hopkins Univ. instrument to test the relationship between remote sensing of fires and the emission of aerosol and trace gases from them(*Kaufman, Wald*).
9. Development of a new technique for remote sensing of dust over land using IR channels, to supplement present algorithm for remote sensing of aerosol from MODIS (*Wald in collaboration with Ackerman, Tanre, Kaufman*)
10. Decentralization of this activity due to possible additional commitment of Kaufman and EOS-AM project scientist (*Kaufman*)

Topics postponed to next quarter

1. The "FIRE" paper describing MODIS fires.
2. Test of the accuracy of separating the aerosol modes in the ocean program. Other sensitivity study.

Plans for the next quarter:

1. Analysis of dust-clouds- climate model (*Kaufman, Mattoo, Tanre*)
2. ATBD for aerosol(*Chu, Kaufman*) Water vapor (*Chu, Gao*) Fire (*Justice*)
3. Validation of the water vapor algorithm using SCAR data (*Chu, Gao*)
3. Lookup tables for the land and ocean algorithms (*Chu, Mattoo*)
4. Analysis of the SCAR-B MAS data for fires, smoke, surface properties and clouds(*Chu, Kleidman, Li, Remer*).

5. Finish of the urban/industrial aerosol paper(*Remer et al.*), Smoke model (*Remer with the Brazilian contingency*).
6. TARFOX field experiment (*Kleidman, Remer et al.*).
7. Analysis of the meaning of remote sensing of aerosol, the meaning of optical thickness, for understanding the aerosol effect on clouds, radiation and atmospheric chemistry(*Kaufman, Tanre*).
8. Laboratory experiment, of remote sensing of fires in the Forest Service Fire Lab. in Sept.(*Kaufman, Wald*).
9. Success in the development of a new technique for remote sensing of dust over land using IR channels(*Wald*).

1.0 Preparation of algorithms for the version 1 delivery

We continued to interact with the SDST team in preparation of the algorithm for the proper format, integration of the auxiliary data and of data from other MODIS algorithms. The codes were tested for software accuracy/consistency and for robustness using sensitivity studies. Input data sets, like the aerosol dynamical models were developed and implemented into the codes. The water vapor and aerosol over ocean were accepted, some modification are scheduled in the aerosol-land code. We prepare for the version 2 codes.

2. 3.75 μm channel

The selection of 3.8 micron over 4.0 micron channels for surface reflectance determination. The channels are apparently shifted by 40-50 nm from what we anticipated. Calculations show a better atmospheric transmission and less sensitivity to the surface temperature is obtained from 3.8 micron channel as opposed to 4.0 micron channel despite the water vapor absorption in 3.8 micron channel.

3. Validation of the algorithms and summary of the scientific results

Performed internal test of aerosol optical thickness derived by MODIS aerosol algorithm with especial focusing on the locations where sunphotometer data are unavailable. Good correlation of the ratios of aerosol optical thickness derived between red and blue channels with those from sunphotometer data are found. For small particles, such as sulfate and smoke, the ratio of optical thickness for red versus blue channel is found to be 1:2, whereas for large particles like dust and sea salt, the ratio is equal to 1.

Calculated a set of solar zenith angle, scattering angle and sun glint angle based upon the MODIS orbital geometry for one orbit per day for a entire year. The optimal coverage of scattering angle of 150 degrees with the minimum error of aerosol optical thickness derived shows the regions including biomass burning from Brazil and Africa, and part of mid-Atlantic US where sulfate aerosol appears to be maximum.

Planning for the validation of precipitable water in near IR channels using satellite measurements (such as AVIRIS) and radiosonde and sunphotometer measurements.

4. Analysis of the SCAR field experiment data

This includes derivation of the relationship of the red and blue reflectance to the 2.2 reflectance, preparation of data for validation of algorithms, preparation of program for analysis of fires in Brazil and MODIS observations of the fires.

5. Workshop on remote sensing of aerosol and atmospheric corrections

The workshop took place during a week in April, with 50 participants from all the new remote sensing platforms. 28 papers were submitted for a JGR special issue on the topic. Brief main conclusions are:

- An order of magnitude step forward in the monitoring of aerosol and assessing their impact on the environment will happen in the next 5 years, by the US, European and Japanese satellites.
- There are overlapping measurements and differences in the analysis technique. This is considered positive in the light of the large uncertainty and difficulty in remote sensing of aerosol.
- The main parameter that is not measured is the single scattering albedo. Without knowledge of this parameter, it is impossible to assess the direct effect of aerosol on climate. This parameter is also critically important for atmospheric correction over the land.

7. The meaning of remote sensing of aerosol

Using calculations and field data we can determine what are the best conditions and best parameters that we should derive from MODIS. Though overall optical thickness is a convenient parameter that is used as input to models, and represents the aerosol loading across orders of magnitude of aerosol sizes, for smoke and urban/industrial aerosol, the aerosol mass is better related to direct forcing, to sources, transport and sinks and to chemical processes than optical thickness. It can be also more accurately derived from the remote sensing data. This is not the case for dust.

10. Decentralization

With the possibility that I (Kaufman) shall take the additional responsibility as EOS-AM project scientist, I shall take a smaller role in the day to day algorithm development and validation. The following are the new points of contact and responsibility for the V2 delivery time frame:

1. Overall leadership - **Remer, Kaufman, Tanre**
2. Aerosol over ocean algorithm - **Mattoo**, science - **Tanre, Kaufman**
3. Aerosol over land algorithm - **Chu**, science - **Chu, Kaufman, Wald**
4. Water vapor algorithm and science - **Chu, Gao**
5. SCAR and Tarfox data and analysis and science, aerosol models- **Remer, Kleidman, Li, Kaufman**
6. Fire algorithm - **Justice**, Science - **Kaufman, Justice Kleidman and Wald.**
7. Monitoring the MODIS specs effect on algorithm - **Chu**
8. Monitoring schedules and complains - **Mattoo**
9. Data archive and analysis - **Li**

Problems, complains

1. There is a long delay in the processing of the scar-b data. Only part of one flight was processed so far.
2. We were not aware of the presumed shift in the IR channels (3.75 and 3.96 μm by 40-50 nm) way out of specs. Looks that we do not understand the new spectral response.